

State of ELN: Current Perceptions and New Paths

Michael H. Elliott



Trends in the market point to the need to explore innovative new directions

The market for electronic laboratory notebook software (ELN) continued its upward growth trend in 2013, though at a slower rate than in previous years. While software sales still experienced a healthy increase north of five percent, it was not the robust 20 to 30 percent experienced in years past. Product sales are estimated at \$130 million, while an additional \$100 million was expended on services, support and maintenance. Due to the ever-larger installed base, services were a notable bright spot with over a 10 percent increase. As companies look to further exploit their existing investment, the expansion of services as a percent of the overall market is expected to continue.

Segment dynamics impacted both growth and the types of products purchased. Investment from sectors who drove market development in years past has slowed due to pervasive penetration. An example of this is medicinal chemistry, where over 60 percent of users already use an ELN. Underpenetrated sectors, such as biologics process development, consumer product, food and beverage, chemicals and energy, are growing at a far larger rate. The expansion of this wide and diverse mix of consumers is impacting approaches to the market, supplier revenue mix and product capabilities.

The fluctuations of biopharmaceutical R&D had a big impact on new software sales. The unfortunate downsizing of operations in large pharmaceutical companies resulted in a plethora of unused licenses and project cancellations. Counter to this is the escalating use of contractors, particularly in Asia for synthetic chemistry, who need to collaborate with partners. In general, these customers command less sophistication and lower pricing. This helped drive higher sales for several of the smaller cloud-based (and less costly) vendors. Outlays by small- and medium-sized companies also were robust.

Expansion of the use of ELN in non-profits continues to be anemic at best. The costs of vendor solutions and product complexity have proven to be major barriers to overcome for many prospective academic users; few solutions have been effective at answering “what’s in it for me?” The lack of need for intellectual property protection and limited funding are stimulating an upsurge in the use of open source software and low-cost tools like Evernote. Pressure on government funding in the US and Europe makes this trend likely for the foreseeable future.

A notable development in 2013 was the formation of a replacement market. Utilizing the technology for several years, a select number of companies commenced projects to evaluate alternative solutions to their existing supplier. Reasons for this are many:

- dissatisfaction with their current system
- changing business requirements
- real or perceived concerns over product longevity

A small number of vendors ceased operations; it was an especially bad year for those systems based on Microsoft SharePoint sold by consulting organizations.

Simplicity vs. Flexibility

Products are considerably more mature than they were three years ago, and the revisions released in 2013 reflect this. Capabilities were introduced to use data more effectively (i.e., integration, analysis, visualization and LIMS-like features), but in many ways, the emphasis of the larger vendors has been on addressing product deficiencies: performance, scalability and bugs. This has left much of the innovation in usability and the cloud to smaller players who do not have the weight of supporting an existing large global client base.

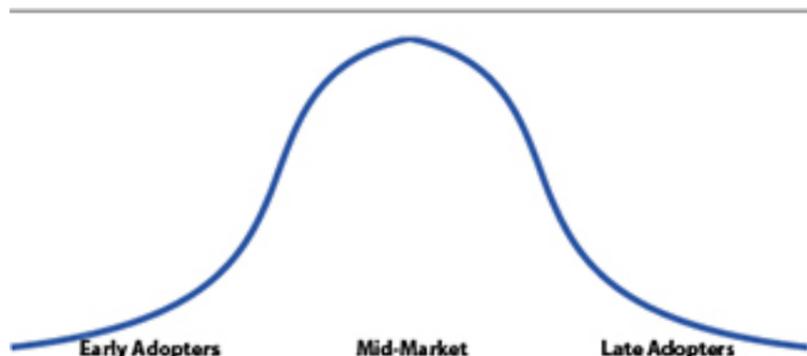
In a survey Atrium Research conducted last fall of major product users, most are generally pleased with their ELN. Synthetic chemists are particularly satisfied with the benefits afforded by the system. When examining what users feel could be improved, there were two noticeable findings. Trending upward for several years, the concerns over product performance and increasing complexity are now widespread. Reflective comments such as: “Too complex,” “Requires too much IT level support,” “Too difficult to administer and maintain,” and “Many issues with upgrades” were across-the-board, independent of vendor. IT professionals seem especially frustrated with the increasing level of support required to make systems perform at an acceptable level.

The demand for features and the resulting increase in complexity was probably to be expected. Informatics convergence in particular (i.e., adding LIMS and SDMS-like capabilities) has exasperated the problem. The motivation to have a single operating environment was never balanced with the architectures necessary to address so many different potential workflows.¹ The more ELN looks like LIMS, the more people express what has become one of the major challenges of LIMS implementations over the years — complexity. Simplicity has given way to flexibility.

The Split: Two Emerging Markets

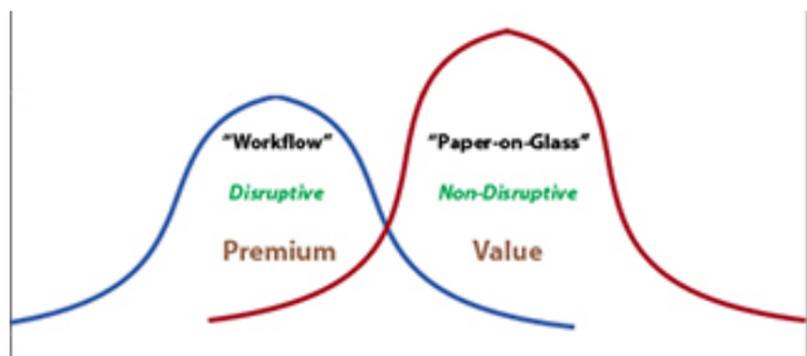
The beginning stage of the ELN market was driven by solutions to specific problems in areas like synthetic chemistry, formulations and quality control. Products were not even categorized as ELN, but morphed into that classification. Users saw beyond the fixed solution and wanted to add capabilities to eliminate the paper notebook and support other domain workflows in a single platform. Vendors added features and modules, companies and products were acquired, and one-size-fits-all solutions were promoted (what is being marketed as “end-to-end solutions” by many suppliers).

But the market is shifting. As it expands beyond the early stage, the mid-market and later stages are asking for fewer capabilities. They are not looking for a change in their workflow, but the ease of experimental documentation and knowledge sharing at the lowest price point and the simplest user experience.



A typical technology adoption curve is presented in Figure 1, highlighting growth from early stage through mid-market to eventual decline. Most technology categories experience these transitions. However, the ELN market is evolving to be a bit different: there is a robust market demanding technology for workflow-structured data management and, at the same time, there is a strong market for those who want a simple system for experimental documentation. Shown in Figure 2, this split is creating two distinct markets, each with their own lifecycle:

- Premium Market: The Premium Market is defined as those who view ELN as a workflow-supporting solution to enable business transformation. These customers are willing to pay a higher price for achieving their objectives. These deployments are mainly domain-specific, where tangible needs of efficiency and cycle time dominate. System capabilities for the Premium Market include structured data management, task workflow and analysis.
- Value Market: The Value Market views ELN as non-disruptive to workflows. The customers prefer the “paper-on-glass” paradigm. Here, there is interest in value, as the system will be deployed broadly across a diverse set of needs. System capabilities are minimal: a general solution for intellectual property protection and knowledge management. User experience is paramount for these customers.



2013 was the first year sales drifted toward the Value side. This is expected to continue, as this market has the greatest unit opportunity. This could be problematic for providers who have invested in a rich and deep set of features to assure premium pricing. The value segment pricing is increasingly elastic as one moves up the curve. Tools like Evernote, new suppliers, and cloud solutions at \$50 to 500 a year will increasingly put pressure on traditional system prices that hover around \$2500 a seat (plus annual support costs at +\$500 per user). This will drive per user unit basis downward as core ELN capabilities are commoditized. Differentiation will come from the value perception of support, size of the organization, stability, company experience, and the number of other organizations using the same technology.

The shift to the emphasis on Value will require greater attention to the user experience, influenced heavily by the “consumerization” of information technology platforms.² The impact on interface perceptions by tablets and smart phones cannot be understated. Many potential users do not know exactly what the ELN should look like, but they do know that the traditional Windows or Web page user interface looks archaic.

'The user experience is already taking a much greater role in product selection. In our consulting practice, we have witnessed evaluations where one vendor is preferred over another due to their “less bad” user interface or the “number of clicks.” Promises of better things to come from vendors are routine, but waiting for the product is a bit like “waiting for Godot.”

Zone of Paralysis

An “Innovation S-Curve” presents a perspective on increases in competitive product value (Y axis) versus investment and time (X axis). As you move up the curve, there is growing competitive advantage based on the investment in new capabilities. However, all good things must come to an end; the curve flattens as competitive advantage diminishes and features are commoditized. All the other competitors have what you have and/or there are now more features than the general user cares about or can absorb. To grow, a subsequent technology that displaces it is represented by another S-Curve. This can overlap the original curve in the case where a product of the same set of capabilities evolves into a new platform. An example of this is the transition from desktop PCs to laptops.

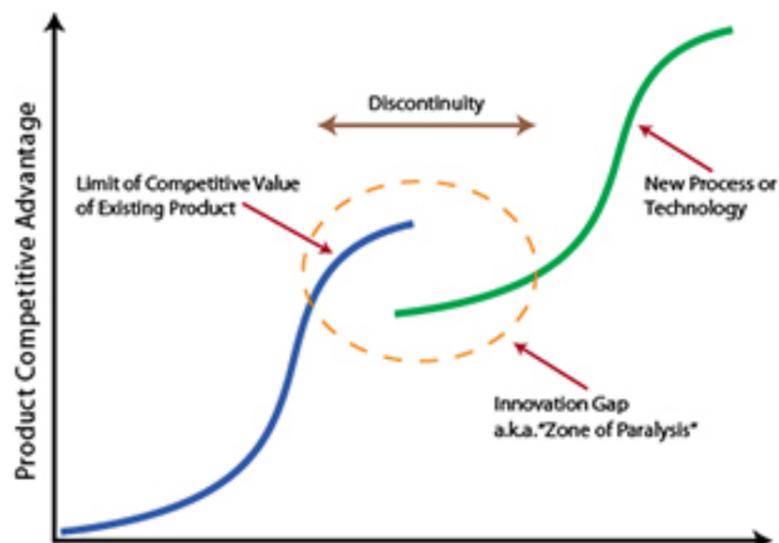


Figure 3 shows the revolutionary transition from an existing product category to a disruptive technology or process. The gap between them is known as the “innovation gap” or “zone of paralysis.” Old paradigms and beliefs can force continued investment in the original product category, blinding developers to alternative ways of thinking.

Digital cameras exemplify the zone of paralysis. For years, there was a “megapixel” war between the point-and-shoot manufacturers like Canon and Nikon. Stuck in the zone, companies invested R&D dollars in more pixels and smaller platforms. But that investment led to the segments undoing, as it blinded them to the changing market. What they did not see coming was disruption by phone cameras and instant uploads to Facebook, Instagram and Twitter. The entire process changed as people traded pixels for mobility, convenience and social connectivity. The result was that many of the point-and-shoot manufacturers abandoned the segment.

The nature of corporate R&D is changing across many fronts: shifts to Asia, partner collaborations, new instrument technology, open team environments, and so on. The paper notebook was born as a method for the individual researcher to document their work with little thought to collaboration with others. To support the future state of R&D, is ELN going to follow an evolutionary path where the existing capabilities are shifted to new platforms (e.g., tablets)? Or should the market abandon current perceptions and biases all together? To avoid being stuck in the innovation gap, one should at least ask if the currently accepted concept of an “electronic laboratory notebook” is even necessary in the future.

Distribution of Truth

It has been often said at informatics conferences that ELN is the “single source of truth” to support intellectual property management. A tool that protects companies, helps lawyers and assists in the knowledge management needs of the scientists. This belief directly led to the “electronic paper” orientation we see in most ELN products. Trying to meet the needs of two masters is morphed into a single platform: supporting the science and supporting the business of science (i.e., the Premium and Value markets).

Analysis of laboratory processes at many ELN customers shows an increasing number of tools creating rising data output volumes. Sometimes, the resulting data are transferred to the ELN, sometimes not. Lawyers tend to not examine notebook records much outside of chemistry, so there is wide variation between departments and users as to what truly goes into the ELN — just as there was in the paper notebook days. Some users include raw data, others just processed data, while others include links to data stored on other systems or servers. Detailed conclusions are often left to project PowerPoints and study reports, which is the true knowledge learned from the experiments.

The reality is that the majority of the data assets generated over the lifecycle of an experiment are scattered across many sources, such as project team sites, data warehouses, registration systems, LIMS, document management systems, SDMS and so forth. Some biology labs do not even use paper notebooks as it is. For example, most high throughput screening (HTS) labs rarely record data into notebooks. The knowledge of their experiments is maintained in workflow automation platforms, bioassay databases and analysis systems. The “truth” of design, prep, execution, data capture and analysis is dispersed across multiple solutions. This means that: Experimental truth is actually distributed; there is no one single source. As workflows are increasingly automated from discovery through development, the distribution of experimental knowledge will increase.

The shifts in the market and the changing nature of R&D should force new thinking about the future of ELN, particularly for the Premium market. There are endless possibilities when one eliminates traditional thinking. For example, in this era of service-oriented-architectures, it is not unreasonable to view experiments as a “web of truth.” Conceptually, data can be tagged in its native system to the experiment with which it is associated. Through federation, the life cycle of the experiment can be assembled when needed from many sources, such as protocols from document management systems, data from materials databases, instrumentation data, automation protocols, and results from assay warehouses. This picture of the experiment could be pushed to a content management system. This aggregation of content could be across organizational boundaries in a collaborative network, supporting distributed research. Maybe the ELN of the future is limited to a design-of-experiment role, using an App-like experience to build component processes into a workflow. When the workflow is executed, the component services could transmit select metadata to a repository when their tasks are completed. This could construct an ongoing description of the experiment(s). The possibilities are endless when separating the business needs from the scientific.

In 1962, noted author and physicist Thomas Kuhn argued in his book, *The Structure of Scientific Revolution*, that scientific advancement is not evolutionary, but is a “series of peaceful interludes punctuated by intellectually violent revolutions,” and “one conceptual world view is replaced by another.” The market for ELN is robust and growing, but consumers are expressing concerns over increasing product complexity. The trends in the market point to the need to explore innovative new paths, replacing the one conceptual view with another. What that new worldview looks like is unknown, but the first step is reflection and abandonment of current perceptions of what an ELN is and must be.

References

1. Elliott, Michael H., “Informatics Convergence Presents Opportunities and Challenges”, *Scientific Computing*, Oct 2011
2. Elliott, Michael H., “Tablets and ELN – A Honeymoon”, *Scientific Computing*, Aug 2012
3. Kuhn, T.S., *The Structure of Scientific Revolutions*, University of Chicago Press, 1962

Michael Elliott is CEO of Atrium Research & Consulting. He may be reached at editor@ScientificComputing.com.

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